CGA Fuel Cell 2001: Experiments and Analyses

In order to meet the academic requirements for our senior design project, the group had to perform four analyses, two experiments, and meet our objectives. This poster details how we accomplished these ends.

Team Objectives

1. To get the Coast Guard Excited about Fuel Cells

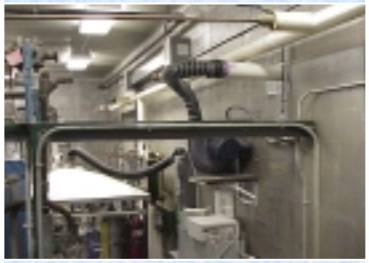
2. To build a real time efficiency demonstration.

3. To meet the twelve requirements for the senior design project.

Pipe Loading Analysis

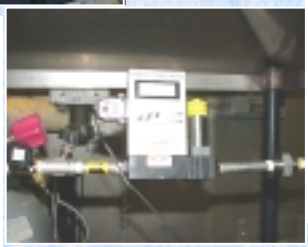
1/c Kowalczyk performed an analysis on the loading condition of the piping system to determine susceptibility to major failure inflicted by a person bumping into the pipe. He found that in the event someone bumped into the hydrogen line, it could cause a rupture pf the solenoid valve which may result in hydrogen ignition. This resulted in the installation of a guard rail to prevent such an accident.

Hydrogen Safety Analysis



1/c McNally performed an analysis to determine the risk in the event of a hydrogen leak. He found that there is minimal risk to the environment because Hydrogen gas dissipates too quickly to form a hazard, and the ventilation system in place is more than sufficient to remove any hazards.

Flowrate Analysis



1/c Hudson performed an analysis to determine the projected flow rates at various power output levels for the fuel cell. This analysis was used in the execution of the real time efficiency display as well as the analysis of the fuel cell's performance

Heat Tape Analysis

1/c Noggle performed an analysis to determine if the heat tapes we had on the cell were too powerful. He found that they were too powerful for both our needs and the circuit they were on. They were replaced with the tapes shown at the right.

Pressure Calibration Experiment

1/c Hudson and 1/c Kowalczyk performed an experiment to calibrate the pressure sensors. This entailed setting the gain manually in the displays, and modeling the pressures with an 18ft column of water. The pressure sensors now read accurately to within 1/100 of a psi.

Flowmeter Calibration Experiment

1/c McNally and 1/c Noggle performed an analysis to calibrate the air flowmeter. They used the inverted bottle immersed in water shown at the right to do so. The flowmeter was verified as accurate to within 1/10 of an SLPM.

Above is the computer displaying the real time efficiency of the fuel cell and the signal conditioning hardware is to the left on the gray cabinet.

Efficiency Experiment Results

The focal point of this project was the Efficiency experiment. This experiment served to give the USCGA community its first real data on the fuel cell and knowledge of its operations, as well as confirming that the real time efficiency diagram we built functions properly. The group generated the following graphs of Voltage vs. Current, and confirmed that our real time efficiency demonstration display does function properly.